UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,526	05/18/2005	Hirotaka Nakamura	6700-85369	9340

22242 7590 10/23/2008

FITCH EVEN TABIN AND FLANNERY
120 SOUTH LA SALLE STREET
SUITE 1600
CHICAGO, IL 60603-3406

EXAMINER	
LIU, LI	

ART UNIT	PAPER NUMBER
2613	

MAIL DATE	DELIVERY MODE
10/23/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/535,526	NAKAMURA ET AL.	
	Examiner	Art Unit	
	LI LIU	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *40-45* is/are allowed.

6)☒ Claim(s) *1,3-7,9-12,14-18,20-24 and 46* is/are rejected.

7)☐ Claim(s) *2,8,13,19 and 25-39* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed on 7/10/2008 with respect to claims 1 and 12 have been fully considered but they are not persuasive. The examiner has thoroughly reviewed Applicant's amendment and arguments but firmly believes that the cited references reasonably and properly meet the claimed limitation as rejected.

1). Applicant's argument – "In the present invention of claim 1, by defining a wavelength difference between the current-use and the reserve-use as the FSR of the AWG and positioning between two ports of AWG, switching between the current-use system and the reserve system can be passively performed by using one AWG" (REMARKS/ARGUMENTS: page 50 line 26 to page 51 line 2).

Examiner's response – According to the original disclosure, the wavelength difference between the current-use and the reserve-use is not defined as the FSR of the AWG. In page 17 line 8 to 12 and page 29 line 13 to page 30 line 5, the wavelength difference between the current-use and the reserve-use is defined in accordance with the locations of the ports of the AWG; or the two ports of the AWG are provided at locations consonant with a different $\Delta\lambda$ between the wavelengths for the current-use and the reserve-use.

A difference between the wavelengths of downstream $\lambda d1$ and upstream $\lambda u1$ is defined as integer times (aFSR) the FSR of the AWG.

2). Applicant's argument – "Applicants amended independent claims 1 and 12 based on the specification page 17, line 8 to 12. Claim limitation of claims 1 and 12 is

that two ports of the AWG are provided at locations consonant with a wavelength difference ($\Delta\lambda$). Regarding the above underlined portion, the claim limitation device that two ports of the AWG pass respectively two optical signals with a wavelength difference ($\Delta\lambda$). In other words, two optical signals propagated through two ports of the AWG have a wavelength difference ($\Delta\lambda$)".

Examiner's response – As disclosed by Gnauck et al (Figure 31, and column 23 line 18-37), the WGR can have two input ports (L4 and L6 in Figure 31) and a plurality of output ports (e.g., to ONU-1 – ONU-N). And Gnauck et al teaches: a plurality of different signals, distinguished by wavelength, may be transmitted from a central office CO to WGR 3100 via optical fiber 3120a; WGR 3100 is adapted to separate these signals based on wavelength and route them to the proper right-side port for transmission to the appropriate ONU 3150; the optical fiber 3120b provides an alternate route for the transmission of a plurality of signals, distinguished by wavelength, from the CO to WGR 3100; because optical fiber 3120a is connected to left-side port L4, and optical fiber 3120b is connected to left-side port L6, a signal routed from optical fiber 3120a to a particular ONU will not be routed to the same ONU from optical fiber 3120b unless a different wavelength λ is used; in particular, if a wavelength λi is used for transmission of a particular signal via optical fiber 3120a, a wavelength λj, where λi is not equal to λj (modulo N), should be used for transmission via optical fiber 3120b; WGR 3100 is therefore preferably used with a COT adapted to transmit a particular signal via optical fiber 3120a with a wavelength λi, and via optical fiber 3120b with a wavelength λj. That is, the two ports (L4 and L6) of the WGR are provided at locations

consonant with a wavelength difference ($\Delta\lambda = \lambda i - \lambda j$) so that the signal from the optical fiber 3120a and the signal from the optical fiber 3120b are routed to a particular/same ONU; or "two optical signals propagated through two ports of the AWG have a wavelength difference ($\Delta\lambda$)".

3). Applicant's argument – "If an optical wavelength division multiplexing access system of Gnauck is combined with two sets of transceiver/transponder for path protection cited in Gerstel and setting a wavelength difference $\Delta\lambda$ between the current-use system and the reserve-use system cited in Han, the construction of claim 1 can not be simply achieved". "If an optical wavelength division multiplexing access system of Gnauck is combined with two sets of transceiver/transponder for path protection cited in Gerstel and two AWGs used for upstream and downstream cited in Akimoto, the construction of claim 12 can not be simply achieved. In the present invention of claim 12, by positioning between two ports of each AWGs, switching between the current-use system and the reserve-use system can be passively performed by using two AWGs".

Examiner's response – Reference Han et al is used to combine with Gnauck to teach that the wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer time a free spectrum range (FSR) of the AWG. Reference Han is not used to teach the wavelength difference $\Delta\lambda$ between the current-use system and the reserve-use system. As discussed above, Gnauck et al teaches that the wavelengths and the locations of the two ports of the WGR must be carefully configured to ensure the signal transmissions (column 19, line 61-65, column 23 line 34-37), or the two ports of the AWG are provided

at locations consonant with a wavelength difference ($\Delta\lambda = \lambda i - \lambda j$) so that the signals inputted at the two ports are routed to the same ONU, or the current-use system and the reserve-use system can be alternatively selected passively by the single AWG.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 3, 4, 7 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al (US H2075) in view of Gerstel et al (Gerstel et al: "Optical Layer Survivability-An Implementation Perspective", IEEE Journal on Selected Areas in Communications, Vol. 18, No. 10, October 2000, pages 1885-1899) and Han et al (US 2004/0213574).

1). With regard to claim 1, Gnauck discloses an optical wavelength division multiplexing access system (e.g., Figure 4), comprising a center node (OSU) (the CO 410 in Figure 4) and n optical network units (ONUs) (e.g., the ONU 470 in Figure 4) are arranged by using a W-MULDEM unit (e.g., the AWG in RN in Figure 4), a multiplexing section between the OSU and the W-MULDEM unit is established by extending a current-use optical fiber (e.g., 420a or 420b in Figure 4) and a redundant optical fiber (e.g., 420b or 420a in Figure 4) and access sections between the W-MULDEM unit and the individual ONUs are established by the extension of optical fibers (e.g., 460 in

Figure 4), wherein downstream optical signals from the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed using wavelengths that are allocated to individual ONUs and the resultant signals are transmitted across the multiplexing section (the signals between the RN and CO are wavelength multiplexed signals), and wherein the W-MULDEM unit performs wavelength multiplexing or wavelength demultiplexing for the upstream or downstream optical signals to provide bidirectional transmission (Figure 4, the RN in Figure 4 provides wavelength multiplexing or wavelength demultiplexing for the upstream or downstream optical signals to provide bidirectional transmission),

the OSU includes:

transmission device (the central office transceiver COTs in Figure 4, or Lasers in Figures 26 and 28) for multiplexing downstream optical signals having wavelengths $\lambda d1$ to λdn that correspond to the ONUs and that are to be transmitted to the ONUs along the current-use optical fiber (e.g., the 2815a in Figure 28), or along the redundant optical fiber (e.g., the 2815b in Figure 28), and for selecting (the switch 2828 in Figure 28) either the current-use optical fiber or the redundant optical fiber for use for transmission, and

reception device (the central office transceiver COTs in Figure 4, or Receivers in Figures 26 and 28) for receiving upstream optical signals having wavelengths $\lambda u1$ to λun along the current-use optical fiber (e.g., the 2810a in Figure 28) or for receiving upstream optical signals having wavelengths $\lambda u1+\Delta\lambda$ to $\lambda un+\Delta\lambda$ along the redundant optical fiber (e.g., the 2810b in Figure 28);

the individual ONUs (the ONUs in Figure 4, or Figures 9-13, 18-23), receive corresponding downstream optical signals having wavelengths λd1 to λdn (e.g., Figure 29-34), or corresponding downstream optical signals which are received along the optical fibers extended across the access sections (Figure 4), the individual ONUs transmit (e.g., the Laser or Modulator in Figures 9-13, 18-23), to the optical fibers extended across the access sections (e.g., 440 in Figure 4, or 910 in Figure 9), corresponding upstream optical signals that have wavelengths λu1 to λun and are to be transmitted along the current-use optical fiber extended across the multiplexing section, or corresponding upstream optical signals that have wavelengths λu1+ Δλ to λun+Δλ and are to be transmitted along the redundant optical fiber (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path);

the W-MULDEM unit includes an array waveguide diffraction grating (AWG) having two ports (Figure 4, the RN is the wavelength grating router WGR or AWG, column 17 line 41-49, the RN in Figure 4 has two input ports and n output ports; note: the AWG is also known as WGR), which are to be respectively connected to the current-use optical fiber (e.g., 440a/420a in Figure 4) and the redundant optical fiber (e.g., 440b/420b in Figure 4), and n ports, which are to be connected to optical fibers corresponding to the ONUs (the ONUs 470 in Figure 4);

the W-MULDEM unit demultiplexes to the ports corresponding to the ONUs the downstream optical signals that have wavelengths λd1 to λdn and are received along the current-use optical fiber (Figure 4, the RN demultiplexes the downstream optical

signals that have wavelengths λd1 to λdn and are received along the current-use optical fiber, e.g., 440a, to the ports corresponding to the ONUs), or the downstream optical signals that are received along the redundant optical fiber (e.g., the fiber 440b in Figure 4), or multiplexes, to the port corresponding to the current-use optical fiber or the redundant optical fiber (the RN multiplexes the signals from the ONUs and transmits the multiplexed signal to the CO via 440a/420a and/or 440b/420b in Figure 4), the upstream optical signals that have wavelengths λu1 to λun or wavelengths λu1+ Δλ to λun+ Δλ and that are received along the optical fibers corresponding to the ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path).

But, in Figures 4, 26 and 28 as cited above, Gnauck et al does not expressly disclose: (A) the OSU includes transmission means for multiplexing downstream optical signals having wavelengths λd1+ Δλ to λdn+ Δλ that correspond to the ONUs and that are to be transmitted to the ONUs along the redundant optical fiber; and ONUs can receive downstream signals having wavelengths λd1+ Δλ to λdn+ Δλ transmitted along the redundant optical fiber; and (B) the W-MULDEM unit demultiplexes the downstream optical signals that have wavelengths λd1+ Δλ to λdn+Δλ and are received along the redundant optical fiber; (C) a wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer times a free spectrum range (FSR) of the AWG; (D) the two ports of the AWG are provided at locations consonant with a wavelength difference (Δλ) between optical

signals transmitted along the current-use optical fiber and optical signals transmitted along the redundant optical fiber corresponding to each of the ONUs.

With regard to items (A), (B) and (D):

in Figures 26 and 28, Gnauck et al teaches that the CO uses one set of transmitters/receivers for both the working path and protection path, and a switch is used to choose the fiber. However, in Figure 31, Gnauck et al teaches that a plurality of different signals, distinguished by wavelength, may be transmitted from a central office CO to WGR 3100 via optical fiber 3120a; and the optical fiber 3120b provides an alternate route for the transmission of a plurality of signals, distinguished by wavelength, from the CO to WGR 3100; and WGR 3100 is adapted to separate these signals based on wavelength and route them to the proper right-side port for transmission to the appropriate ONU 3150. That is, one of the fibers 3120a and 3120b can be viewed as the current-used optical fiber, and another can be viewed as the redundant optical fiber.

And Gnauck et al also teaches: because optical fiber 3120a is connected to left-side port L4, and optical fiber 3120b is connected to left-side port L6, a signal routed from optical fiber 3120a to a particular ONU will not be routed to the same ONU from optical fiber 3120b unless a different wavelength λ is used; in particular, if a wavelength λi is used for transmission of a particular signal via optical fiber 3120a, a wavelength λj, where λi is not equal to λj (modulo N), should be used for transmission via optical fiber 3120b; WGR 3100 is therefore preferably used with a COT adapted to transmit a particular signal via optical fiber 3120a with a wavelength λi, and via optical fiber 3120b with a wavelength λj. That is, the two ports (L4 and L6) of the WGR are provided at

<u>locations consonant with</u> a wavelength difference ($\Delta\lambda = \lambda i - \lambda j$) so that the signals from the optical fiber 3120a and the signal from the optical fiber 3120b are routed to a particular/same ONU; or “two optical signals propagated through two ports of the AWG have a wavelength difference ($\Delta\lambda$)”. That is, Gnauck et al teaches “the two ports of the AWG are provided at locations consonant with a wavelength difference ($\Delta\lambda$) between optical signals transmitted along the current-use optical fiber and optical signals transmitted along the redundant optical fiber corresponding to each of the ONUs”.

To use separate transmitters for working path and protection path is well known and widely used in the art. Gerstel et al teaches two sets of transceivers/transponders for path protections (e.g., Figure 2(a) and Figure 4(a)). By using two sets of transceivers/transponders, the system can be more reliable and it can protect against transceiver/transponder failures. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use two sets of transceivers as taught by Gerstel et al to the system of Gnauck et al so that the multilayers of protection can be realized. Since the combination of Gnauck et al and Gerstel et al teaches the separate transceivers for working paths and protection path, it is obvious that the protection transceivers can transmit another set of wavelengths, such as $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$, which can be different from the wavelengths of the working path, to the redundant fiber (also, refer to Figure 9(a) of Gerstel et al), and then the W-MULDEM unit demultiplexes the downstream optical signals that have wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$ and are received along the redundant optical fiber.

With regard to item (C), Han et al, in the same field of endeavor, teaches a system and method for passive optical network in which the wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer time a free spectrum range (FSR) of the AWG (Figures 2 and 3, [0029]). As disclosed by Gnauck et al, the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (column 19, line 61-65, column 23 line 34-37).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the wavelength arrangement as taught by Han et al to the system of Gnauck et al and Gerstel et al so that one AWG/WGR can process two sets of signals and the upstream and downstream signals can be input/output through one port, and then the system can be simplified.

2). With regard to claim 3, Gnauck et al and Gerstel et al and Han et al discloses all of the subject matter as applied to claim 1 above. And Gnauck et al and Gerstel et al and Han et al further disclose when λd1, λd2, . . . and λdn are defined as wavelengths of downstream optical signals (e.g., Figure 26 of Gnauck et al; or Figure 3 of Hans) that are transferred along the current-optical fiber and correspond to the ONUs, and when a wavelength interval is a constant, defining λd1+ k, λd2+k, . . . and λdn+k ($1 \leq k < n$) as wavelengths of downstream optical signals that are transferred along the redundant optical fiber to the ONUs (the protection transceivers can transmit another set of wavelengths, such as λd1+ Δλ to λdn+Δλ, which can be different from the wavelengths of the working path, to the redundant fiber), and

when $\lambda u1$, $\lambda u2$, . . . and λun are defined as wavelengths of upstream optical signals that are transferred along the current-optical fiber and correspond to the ONUs, and when a wavelength interval is a constant, defining $\lambda u1+k$, $\lambda u2+k$, . . . and $\lambda un+k$ (k is an integer of one or greater) as wavelengths of upstream optical signals that are transferred along the redundant optical fiber to the ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path).

3). With regard to claim 4, Gnauck et al and Gerstel et al and Han et al disclose all of the subject matter as applied to claim 1 above. But, Gnauck et al does not expressly disclose wherein: replacing $\lambda dn+i$ with λdi when $\lambda dn+i=\lambda di+FSR$ is established; and replacing $\lambda un+i$ with λui when $\lambda un+i=\lambda ui+FSR$ is established (i is an integer of 1 to k).

However, since the combination of Gnauck et al and Gerstel et al and Han et al teach that the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (Gnauck et al: column 19, line 61-65, column 23 line 34-37) and the wavelengths between the upstream and downstream channels can differ by FSR, it is obvious that the $\lambda dn+i$ can be replaced with λdi when $\lambda dn+i=\lambda di+FSR$ is established and the $\lambda un+i$ can be replaced with λui when $\lambda un+i=\lambda ui+FSR$ is established.

4). With regard to claim 7, Gnauck et al and Gerstel et al and Han et al disclose all of the subject matter as applied to claim 1 above. And Gnauck et al further discloses the optical wavelength division multiplexing access system wherein the OSU includes: a unit for individually detecting a transmission cutoff of downstream signals (column 30,

line 37 to column 31 line 13, the CO provides both OTDR measurements and tracking system for individually detecting a transmission cutoff of downstream signals).

5). With regard to claim 46, Gnauck et al and Gerstel et al and Han et al disclose all of the subject matter as applied to claim 1 above. And Gnauck et al and Gerstel et al and Han et al further discloses the optical wavelength division multiplexing access system characterized by: allocating, for an arbitrary ONU, two wavelengths or more for a downstream current-use optical signal, a downstream reserve optical signal, an upstream current-use optical signal and an upstream reserve optical signal, so as to obtain a dual structure for optical fibers at the access sections (the combination of Gnauck et al and Gerstel et al and Han et al teaches two sets of transceivers in CO, so to allocate, for an arbitrary ONU, two or more wavelengths for the downstream current-use optical signal and the downstream reserve optical signal. And Gnauck also teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path, column 7, line 46-51; in Figure 23. A dual structure for optical fibers, 440a and 440b, at the access sections is also shown in Figure 4).

4. Claim 5, 6, 9, 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel and Han et al as applied to claim 1 above, and in further view of Darcie et al (US 5,907,417).

Gnauck et al and Gerstel and Han et al disclose all of the subject matter as applied to claim 1 above. And Gnauck et al further discloses wherein the OSU includes:

switching device for changing from the upstream (or downstream) current-use optical fiber to the upstream (or downstream) redundant optical fiber (e.g., Figures 15, 17 and 28); and

a supervisory control unit (the supervisory control unit must be present in the system so that the monitoring and switching is done smoothly, column 30, line 37 to column 31 line 13, the CO provides both OTDR measurements and tracking system), for detecting a transmission cutoff of upstream signals from the ONUs, and for transmitting a selection signal to the switching device, and

when a transmission cutoff of all upstream optical signals is detected by the supervisory control unit that detects a transmission cutoff of upstream optical signals from the ONUs, the supervisory control unit performs a process for transmitting a selection signal (e.g., the control signal in Figure 28) to perform communication using the redundant optical fiber (column 30, line 37 to column 31 line 13); and

when a transmission cutoff of a plurality of upstream optical signals is detected by the supervisory control that detects a transmission cutoff of upstream optical signals from the ONUs (the cutoff of a plurality of upstream optical signals can be detected and measured, column 30, line 37 to column 31 line 13), the supervisory control unit performs a process for transmitting a selection signal (e.g., the control signal in Figure 28) to perform communication using the redundant optical fiber (column 30, line 37 to column 31 line 13).

But, Gnauck et al does not expressly state to collectively or individually detect a transmission cutoff of upstream signals from the ONUs.

However, as disclosed by Gnauck et al: the CO is adapted to poll a path under repair, to insure that the repair is being made properly, and that the proper fibers are being spliced together; also, such polling would be greatly simplified if each ONU was able to identify itself, so that the CO could confirm that the proper equipment was being connected. OTDR measurements could be made, and compared to previous OTDR measurements on file. That is the Gnauck et al’s system can perform both collectively detection and individually detection of the transmission cutoff of upstream signals.

Another prior art, Darcie et al, in the same field of endeavor, also teaches a supervisory control unit for collectively or individually detecting a transmission cutoff of upstream signals from the ONUs (Figures 1-4). Darcie et al teaches that the network 10 may perform a diagnostic operation that determines the status of only upstream transmission. In this test, the diagnostic receiver 32 performs analysis using the upstream communication signals (that is, the signals from the ONUs can be analyzed collectively). And, the upstream communication signals contain distinct, interleaved spectral components, each spectral component corresponding to a particular ONU. The diagnostics receiver 32, which may suitably be a wavelength sensitive diagnostic device, such as an optical spectrum analyzer, analyzes the frequency content of the multiplexed upstream communication signal to determine the status of the individual ONUs. Problems associated with a particular ONU's upstream transmission may be detected by examining the optical spectrum corresponding to the ONU, as determined by the WGR 100 in the remote node 22 (that is, the system can individually detect a transmission cutoff of upstream signals from the ONUs).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of fault detection as taught by Darcie et al to the system of Gnauck et al and Gerstel et al and Han et al so the fiber cut and ONU or other equipment failures can be detected and diagnosed accurately and rapidly.

5. Claims 12, 14, 18 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al (US H2075) in view of Gerstel et al (Gerstel et al: “Optical Layer Survivability-An Implementation Perspective”, IEEE Journal on Selected Areas in Communications, Vol. 18, No. 10, October 2000, pages 1885-1899) and Akimoto et al (US 2003/0039010).

1). With regard to claim 12. Gnauck discloses an optical wavelength division multiplexing access system (e.g., Figures 3 and 4), whereby a center node (OSU) (the CO in Figures 3 and 4) and n optical network units (ONUs) (e.g., the ONUs in Figures 3 and 4) are arranged through a W-MULDEM unit (e.g., the AWG in RN in Figures 3 and 4), whereby a multiplexing section between the OSU and the W-MULDEM unit is established by extending a current-use downstream optical fiber (e.g., 2815a in Figure 28), a current-use upstream optical fiber (e.g., 2810a in Figure 28), a reserve downstream optical fiber (e.g., 2815b in Figure 28) and a reserve upstream optical fiber (e.g., 2810b in Figure 28) and access sections between the W-MULDEM unit and the individual ONUs are established by the extension of downstream optical fibers (e.g., the fibers from ONUs to WGR in Figures 30-34) and of upstream optical fibers (e.g., the fibers from WGR to ONUs in Figures 30-34), whereby downstream optical signals from

the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed, using wavelengths that are allocated to the individual ONUs, and resultant optical signals are transmitted across the multiplexing section (the signals between the RN and CO are wavelength multiplexed signals), and whereby the W-MULDEM unit performs either wavelength multiplexing or wavelength division for the upstream or downstream optical signals to provide bidirectional transmission (Figures 3 and 4, the RN provides wavelength multiplexing or wavelength demultiplexing for the upstream or downstream optical signals to provide bidirectional transmission),

wherein the OSU includes

transmission device (the central office transceiver COTs in Figures 3 and 4, or Lasers in Figures 26 and 28) for multiplexing downstream optical signals having wavelengths $\lambda d1$ to λdn that correspond to the ONUs and that are to be transmitted to the ONUs along the current-use downstream optical fiber (e.g., the 2815a in Figure 28) or along the reserve downstream optical fiber (e.g., the 2815b in Figure 28), and for selecting (the switch 2828 in Figure 28) either the current-use downstream optical fiber or the reserve downstream optical fiber used for transmission, and

receivers (the central office transceiver COTs in Figure 4, or Receivers in Figures 26 and 28) for receiving upstream optical signals having wavelengths $\lambda u1$ to λun transmitted along the current-use upstream optical fiber (e.g., the 2810a in Figure 28), or for receiving upstream optical signals having wavelengths $\lambda u1+\Delta\lambda$ to $\lambda un+\Delta\lambda$ transmitted along the reserve upstream optical fiber (e.g., the 2810b in Figure 28);

the ONUs (the ONUs in Figures 3 and 4, or Figures 9-13, 18-23 and 30-34) receive, along the optical fibers extended across the access sections, corresponding downstream optical signals having wavelengths λd1 to λdn (e.g., Figures 29-34) or corresponding downstream reserved optical signals, the ONUs transmit (e.g., the Laser or Modulator in Figures 9-13, 18-23 and 30-33), to the optical fibers extended across the access sections, corresponding upstream optical signals that have wavelengths λu1 to λun and that are to be transmitted along the current-use optical fiber extended across the multiplexing section (e.g., the fibers between the WGR and ONUs in Figures 30-33), or corresponding upstream optical signals that have wavelengths λu1+ $\Delta\lambda$ to λun+$\Delta\lambda$ and are to be transmitted along the redundant optical fiber (column 7, line 46-51; Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path);

the W-MULDEM unit includes

a downstream array waveguide diffraction grating (e.g., Figures 31, 33 and 34, the WGR serves as a downstream/upstream combined array waveguide diffraction grating) having two ports on one side (the RN is the wavelength grating router WGR or AWG, the RN in Figures 31, 33 and 34 has two ports: e.g.,), which are to be respectively connected to the current-use downstream optical fiber and the reserve downstream optical fiber (e.g., the fibers 3110 and 3120, 3310 and 3320 in Figures 31 and 33), and 2xn ports (e.g., the 2n ports connected to the ONUs in Figures 30-34), which are to be connected to optical fibers corresponding to the ONUs; and

a downstream/upstream combined array waveguide diffraction grating (e.g., Figures 31, 33 and 34, the WGR serves as both downstream AWG and upstream AWG) having four ports on one side (the RN is the wavelength grating router WGR or AWG, the RN in Figures 31, 33 and 34 has four ports on one side: two inputs and two outputs and 2n ports: n inputs and n outputs, n is the number of ONUs), which are to be respectively connected to the current-use downstream optical fiber and the reserve downstream optical fiber (e.g., the two input ports L4 and L6 for downstream current-use and reserve downstream fibers: the fibers 3120a and 3120b in Figure 31, or 3310a and 3320b in Figure 33) and to be respectively connected to the current-use upstream optical fiber and the reserve upstream optical fiber (e.g., the two output ports L3 and L5 for upstream current-use and reserve upstream fibers: the fibers 3110a and 3110b in Figure 31, or 3320a and 3310b in Figure 33), and 2xn ports (e.g., the 2n ports connected to the ONUs in Figures 30, 33 and 34), which are to be connected to optical fibers corresponding to the ONUs; and

the W-MULDEM unit demultiplexes to the ports of the downstream AWG that correspond to the ONUs the downstream optical signals that have wavelengths $\lambda d1$ to λdn (Figures 30-34, the RN demultiplexes the downstream optical signals that have wavelengths $\lambda d1$ to λdn and are received along the current-use optical fiber, e.g., 440a, to the ports corresponding to the ONUs) and are received along the current-use downstream optical fiber (e.g., the fiber 3120a in Figure 31 or 3310a in Figure 33), or the downstream optical signals that are received along the reserve downstream optical fiber (e.g., the fiber 3120b in Figure 31 or 3320b in Figure 33), or multiplexes, to the port

corresponding to the current-use upstream optical fiber or the reserve upstream optical fiber, the upstream optical signals that have wavelengths $\lambda u1$ to λun or wavelengths $\lambda u1+ \Delta\lambda$ to $\lambda un+ \Delta\lambda$ and that are transmitted to the upstream AWG along the optical fibers corresponding to the ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path; Figures 31-34, column 23 line 16-49).

And in Figure 31, Gnauck et al teaches that a plurality of different signals, distinguished by wavelength, may be transmitted from a central office CO to WGR 3100 via optical fiber 3120a; and the optical fiber 3120b provides an alternate route for the transmission of a plurality of signals, distinguished by wavelength, from the CO to WGR 3100; and WGR 3100 is adapted to separate these signals based on wavelength and route them to the proper right-side port for transmission to the appropriate ONU 3150. That is, one of the fibers 3120a and 3120b can be viewed as the current-used optical fiber, and another can be viewed as the redundant optical fiber.

And Gnauck et al also teaches: because optical fiber 3120a is connected to left-side port L4, and optical fiber 3120b is connected to left-side port L6, a signal routed from optical fiber 3120a to a particular ONU will not be routed to the same ONU from optical fiber 3120b unless a different wavelength λ is used; in particular, if a wavelength λi is used for transmission of a particular signal via optical fiber 3120a, a wavelength λj, where λi is not equal to λj (modulo N), should be used for transmission via optical fiber 3120b; WGR 3100 is therefore preferably used with a COT adapted to transmit a particular signal via optical fiber 3120a with a wavelength λi, and via optical fiber 3120b

with a wavelength λj. That is, the two ports (L4 and L6) of the WGR are provided at locations consonant with a wavelength difference ($\Delta\lambda = \lambda i - \lambda j$) so that the signal from the optical fiber 3120a and the signal from the optical fiber 3120b are routed to a particular/same ONU; or “two optical signals propagated through two ports of the AWG have a wavelength difference ($\Delta\lambda$)”.

That is, Gnauck et al teaches “the two ports of the downstream AWG are provided at locations consonant with a wavelength difference ($\Delta\lambda d$) between optical signals transmitted along the current-use downstream optical fiber and optical signals transmitted along the redundant downstream optical fiber corresponding to each of the ONUs”.

Gnauck et al also teaches (column 23, line 38-49): similarly, each ONU 3150 may transmit a signal to WGR 3100, where each such signal has a particular wavelength; WGR 3100 is adapted to route each of these signals to either left-side port L3 for transmission to a CO via optical fiber 3110a, or to left-side port L5 for transmission to a CO via optical fiber 3110b, depending on the particular wavelength used by an ONU to transmit signals to WGR 3100; and WGR 3100 is therefore preferably used with ONUs 3150 adapted to transmit signals having different wavelengths, for example by using a wavelength-tunable laser or a pair of wavelength specified lasers of different wavelengths. That is, the two wavelengths outputted from a particular ONU must have a wavelength difference ($\Delta\lambda u$) so that the one signal is routed to L3 and another is routed to L5.

That is, Gnauck et al teaches "the two ports of the upstream AWG are provided at locations consonant with a wavelength difference ($\Delta\lambda u$) between optical signals transmitted along the current-use upstream optical fiber and optical signals transmitted along the redundant upstream optical fiber corresponding to each of the ONUs".

In Figures 31, 33 and 34, Gnauck et al shows a single AWG for both upstream and downstream transmissions, and the WGR can have four inputs on one side and 2n ports on the other side (e.g., Figures 33 and 34).

But, in Figures 3, 4 and 28 as cited above, Gnauck et al does not expressly disclose: (A) the OSU includes transmission device for multiplexing downstream optical signals having wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$ that correspond to the ONUs and that are to be transmitted to the ONUs along the reserve downstream optical fiber, and ONUs receive corresponding downstream optical signals having wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$; (B) two separate AWGs that performs downsteam signals and upstream signals, respectively.

With regard to item (A), however, as discussed above, Gnauck et al teaches that a plurality of different signals, distinguished by wavelength, may be transmitted from a central office CO to WGR 3100 via optical fiber 3120a; and the optical fiber 3120b provides an <u>alternate route</u> for the transmission of a plurality of signals, distinguished by wavelength, from the CO to WGR 3100; and WGR 3100 is adapted to separate these signals based on wavelength and route them to the proper right-side port for transmission to the appropriate ONU 3150. That is, one of the fibers 3120a and 3120b can be viewed as the current-used optical fiber (for one set of multiplexed signal, and a

multiplexer must be present in the CO to multiplex the signals), and another can be viewed as the redundant optical fiber (for another set of multiplexed signal, and a multiplexer must be present in the CO to multiplex the signals).

To use separate transmitters for working path and protection path is well known and widely used in the art. Gerstel et al teaches two sets of transceivers/transponders for path protections (e.g., Figure 2(a) and Figure 4(a)). By using two sets of transceivers/transponders, the system can be more reliable and it can protect against transceiver/transponder failures. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use two sets of transceivers as taught by Gerstel et al to the system of Gnauck et al so that the multilayers of protection can be realized. Since the combination of Gnauck et al and Gerstel et al teaches the separated transceivers for working paths and protection path, it is obvious that the protection transceivers can transmit another set of wavelengths, such as $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$, which can be different from the wavelengths of the working path, to the redundant fiber (also, refer to Figure 9(a) of Gerstel et al), and then the W-MULDEM unit demultiplexes the downstream optical signals that have wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$ and are received along the redundant optical fiber and ONUs receive corresponding downstream optical signals having wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$.

With regard to item (B), although Gnauck et al doesn't specifically disclose the two separate AWG, such limitation are merely a matter of design choice and would have been obvious in the system of Gnauck et al; Gnauck et al teaches that the two

downstream signals along the downstream working and protection paths are demultiplexed by the AWG and sent to the respective ONUs, and the upstream working and protection signals from the individual ONUs are multiplexed by the AWG and sent to the upstream working and protection paths. The limitations in claim 12 do not define a patentably distinct invention over that in Gnauck et al since both the invention as a whole and Gnauck et al are directed to mutiplex/demutiplex the upstream/downstream signals from/to individual fibers. Therefore, to use a single AWG for upstream/downstream or use two AWGs (one for upstream, another for downstream) would have been a matter of obvious design choice to one of ordinary skill in the art.

Also, another prior art, Akmoto et al, teaches a system in which two AWGs are used for upstream and downstream, respectively (e.g., 57-1 and 57-2 in Figures 4 and 5). In Figure 3, Gnauck et al also teaches that two separate RNs can be used to route the signals, and one RN failure does not impact another RN.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply two individual AWGs as taught by Akmoto et al to the system of Gnauck et al and Gerstel et al so that the system can be fully protected.

2). With regard to claim 14, Gnauck et al and Gerstel et al and Akimoto et al discloses all of the subject matter as applied to claim 12 above. And Gnauck et al and Gerstel et al and Akimoto et al further disclose wherein,

when $\lambda d1$, $\lambda d2$, . . . and λdn are defined as wavelengths of downstream optical signals (e.g., Figure 26 of Gnauck et al; or Figure 7 of Akimoto) that are transferred along the current-optical fiber and correspond to the ONUs, and when a wavelength

interval is a constant, defining λd1+ k, λd2+k, . . . and λdn+k ($1 \le k < n$) as wavelengths of downstream optical signals that are transferred along the redundant optical fiber to the ONUs (the protection transceivers can transmit another set of wavelengths, such as λd1+ Δλ to λdn+Δλ, which can be different from the wavelengths of the working path, to the redundant fiber), and

when λu1, λu2, . . . and λun are defined as wavelengths of upstream optical signals that are transferred along the current-optical fiber and correspond to the ONUs, and when a wavelength interval is a constant, defining λu1+k, λu2+k, . . . and λun+k (k is an integer of one or greater) as wavelengths of upstream optical signals that are transferred along the redundant optical fiber to the ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path).

3). With regard to claim 18, Gnauck et al and Gerstel et al and Akimoto et al disclose all of the subject matter as applied to claim 12 above. And Gnauck et al further discloses wherein the OSU comprises: a unit for individually detecting a transmission cutoff of downstream signals (column 30, line 37 to column 31 line 13, the CO provides both OTDR measurements and tracking system for individually detecting a transmission cutoff of downstream signals).

4). With regard to claim 23, Gnauck et al and Gerstel et al and Akimoto et al disclose all of the subject matter as applied to claim 12 above. And Gnauck et al further discloses wherein wavelengths of downstream current-use optical signals that correspond to the ONUs are equalized with wavelengths of upstream current-use

optical signals, and wavelengths of downstream reserve optical signals are equalized with wavelengths of upstream reserve optical signals (in Figure 19, the partial of the downstream signals are modulated by the modulator 1960 and then transmitted the signals having the same wavelength back to the CO). Also, since the combination of Gnauck et al and Gerstel et al and Akimoto et al teaches two sets of transmitters, two RNs and two upstream fibers and two downstream fibers, therefore, it is obvious that that the wavelengths of downstream and upstream signals can be equalized, and wavelengths of downstream reserve optical signals can be equalized with wavelengths of upstream reserve optical signals since these signals are transmitted via different fibers and no interferences between the different signals.

6. Claims 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel et al and Akimoto et al as applied to claims 12 and 14 above, and in further view of Han et al (US 2004/0213574).

Gnauck et al and Gerstel et al and Akimoto et al disclose all of the subject matter as applied to claim 12 above. But, Gnauck et al does not expressly disclose wherein, replacing λdn+i with λdi when λdn+i=λdi+FSR is established; and replacing λun+i with λui when λun+i=λui+FSR is established (i is an integer of 1 to k).

However, Han et al, in the same field of endeavor, teaches a system and method for passive optical network in which the wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer time a free spectrum range (FSR) of the AWG (Figures 2 and 3, [0029]). As

disclosed by Gnauck et al, the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (column 19, line 61-65, column 23 line 34-37).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the wavelength arrangement as taught by Han et al to the system of Gnauck et al and Gerstel et al and Akimoto et al so that the AWG can process multiple sets of signals and the λdn+i can be replaced with λdi when λdn+i=λdi+FSR is established and the λun+i can be replaced with λui when λun+i=λui+FSR is established; and the system can be simplified.

7. Claims 16, 17 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel et al and Akimoto et al as applied to claims 12 above, and in further view of Darcie et al (US 5,907,417).

Gnauck et al and Gerstel and Akimoto et al disclose all of the subject matter as applied to claim 12 above. And Gnauck et al further discloses wherein the OSU comprises: switching device for changing from the upstream (or downstream) current-use optical fiber to the upstream (or downstream) redundant optical fiber (e.g., Figures 15, 17 and 28); and a supervisory control unit (the supervisory control unit must be present in the system so that the monitoring and switching is done smoothly, column 30, line 37 to column 31 line 13, the CO provides both OTDR measurements and tracking system), for detecting a transmission cutoff of upstream signals from the ONUs, and for transmitting a selection signal to the switching device, and when a transmission cutoff of all upstream optical signals is detected by the means that detects a transmission cutoff of upstream optical signals from the ONUs, the supervisory control unit performs a

process for transmitting a selection signal (e.g., the control signal in Figure 28) to perform communication using the redundant optical fiber (column 30, line 37 to column 31 line 13), and when a transmission cutoff of a plurality of upstream optical signals is detected by the unit that detects a transmission cutoff of upstream optical signals from the ONUs (the cutoff of a plurality of upstream optical signals can be detected and measured, column 30, line 37 to column 31 line 13), the supervisory control unit performs a process for transmitting a selection signal (e.g., the control signal in Figure 28) to perform communication using the redundant optical fiber (column 30, line 37 to column 31 line 13).

But, Gnauck et al does not expressly state to collectively or individually detect a transmission cutoff of upstream signals from the ONUs.

However, as disclosed by Gnauck et al: the CO is adapted to poll a path under repair, to insure that the repair is being made properly, and that the proper fibers are being spliced together; also, such polling would be greatly simplified if each ONU was able to identify itself, so that the CO could confirm that the proper equipment was being connected. OTDR measurements could be made, and compared to previous OTDR measurements on file. That is the Gnauck et al's system can perform both collectively detection and individually detection of the transmission cutoff of upstream signals.

Another prior art, Darcie et al, in the same field of endeavor, also teaches a supervisory control unit for collectively or individually detecting a transmission cutoff of upstream signals from the ONUs (Figures 1-4). Darcie et al teaches that the network 10 may perform a diagnostic operation that determines the status of only upstream

transmission. In this test, the diagnostic receiver 32 performs analysis using the upstream communication signals (that is, the signals from the ONUs can be analyzed collectively). And, the upstream communication signals contain distinct, interleaved spectral components, each spectral component corresponding to a particular ONU. The diagnostics receiver 32, which may suitably be a wavelength sensitive diagnostic device, such as an optical spectrum analyzer, analyzes the frequency content of the multiplexed upstream communication signal to determine the status of the individual ONUs. Problems associated with a particular ONU's upstream transmission may be detected by examining the optical spectrum corresponding to the ONU, as determined by the WGR 100 in the remote node 22 (that is, the system can individually detect a transmission cutoff of upstream signals from the ONUs).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of fault detection as taught by Darcie et al to the system of Gnauck et al and Gerstel et al and Akimoto et al so the fiber cut and ONU or other equipment failures can be detected and diagnosed accurately and rapidly.

8. Claims 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel et al and Akimoto et al as applied to claim 12 above, and in further view of Han et al (US 2004/0213574).

Gnauck et al and Gerstel and Akimoto et al disclose all of the subject matter as applied to claim 12 above. And Gnauck et al and Gerstel and Akimoto et al further disclose wherein the OSU comprises:

a device for oscillating optical carriers (e.g., the C band light source in Figure 2, or 1163 in Figure 21 of Akimoto) having wavelengths λu1 to λun, which are used for upstream signals, so as to permit the ONUs to generate upstream optical signals, and for multiplexing the optical carriers and transmitting a resultant carrier to the downstream current-use optical fiber, and

the ONUs include:

a device (e.g., the modulator 1172 in Figure 21 of Akimoto) for modulating corresponding optical carriers, used for upstream signals, from among those that are received while multiplexed with downstream optical signals, and transmitting thereby obtained signals as upstream optical signals having wavelengths λu1 to λun (Figure 21) or wavelengths λu1+ Δλu to λun+ Δλu; and

the downstream AWG provided for the W-MULDEM unit is so constituted as to separate, at the same time, the downstream optical signals and the optical carriers, used for upstream signals, which correspond to the ONUs (the AWG in Figure 21 separate the downstream optical signals and the optical carriers used for upstream signals, to respective ONUs).

But, Gnauck et al and Gerstel and Akimoto et al do not expressly disclose: (A) a device for oscillating optical carriers having wavelengths λu1+Δλu to λun+Δλu, which are used for upstream signals, so as to permit the ONUs to generate upstream optical signals, and for multiplexing the optical carriers and transmitting a resultant carrier to the downstream redundant optical fiber; (B) a wavelength difference between the downstream optical signals and the upstream optical signals corresponding to the

ONUs is defined as integer times a free spectrum range (FRS) of the downstream AWG.

With regard to item (A), the combination of Gnauck et al and Gerstel and Akimoto et al teaches a working system and a protection system, and Akimoto et al teaches means for oscillating optical carriers for working system, therefore, it is obvious to one skilled in the art also apply another means for oscillating optical carriers having wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$, which are used for upstream signals to the system of Gnauck et al and Gerstel and Akimoto et al, so as to permit the ONUs to generate upstream optical signals, and for multiplexing the optical carriers and transmitting a resultant carrier to the downstream redundant optical fiber.

With regard to item (B), Han et al, in the same field of endeavor, teaches a system and method for passive optical network in which the wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer times a free spectrum range (FSR) of the AWG (Figures 2 and 3, [0029]). As disclosed by Gnauck et al, the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (column 19, line 61-65, column 23 line 34-37).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the wavelength arrangement as taught by Han et al to the system of Gnauck et al and Gerstel et al and Akimoto et al so that one AWG/WGR can process multiple sets of signals, and then signal routing can be made easier and the system can be simplified.

Allowable Subject Matter

9. Claims 2, 8, 13, 19 and 25-39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. Claims 40-45 are allowed.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tervonen et al (US 2005/0036785);

Eijk et al (US 6,868,232);

Kumozaki et al (US 5,539,564);

Lee et al (US 2003/0142978).

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/L. L./
Examiner, Art Unit 2613
October 17, 2008

/Kenneth N Vanderpuye/
Supervisory Patent Examiner, Art Unit 2613